

Fluorescence Polarization Using Smartphone-Base System

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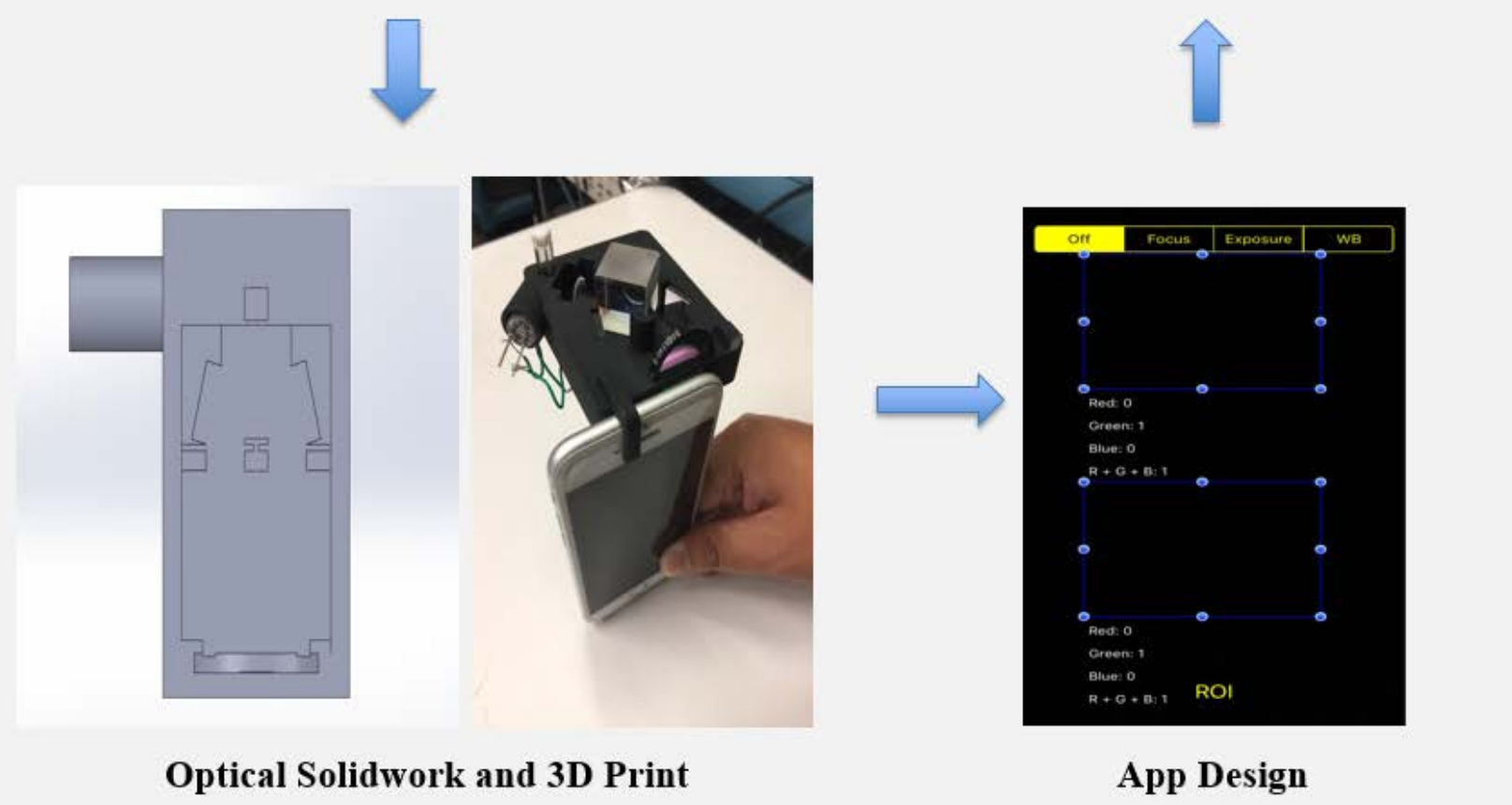
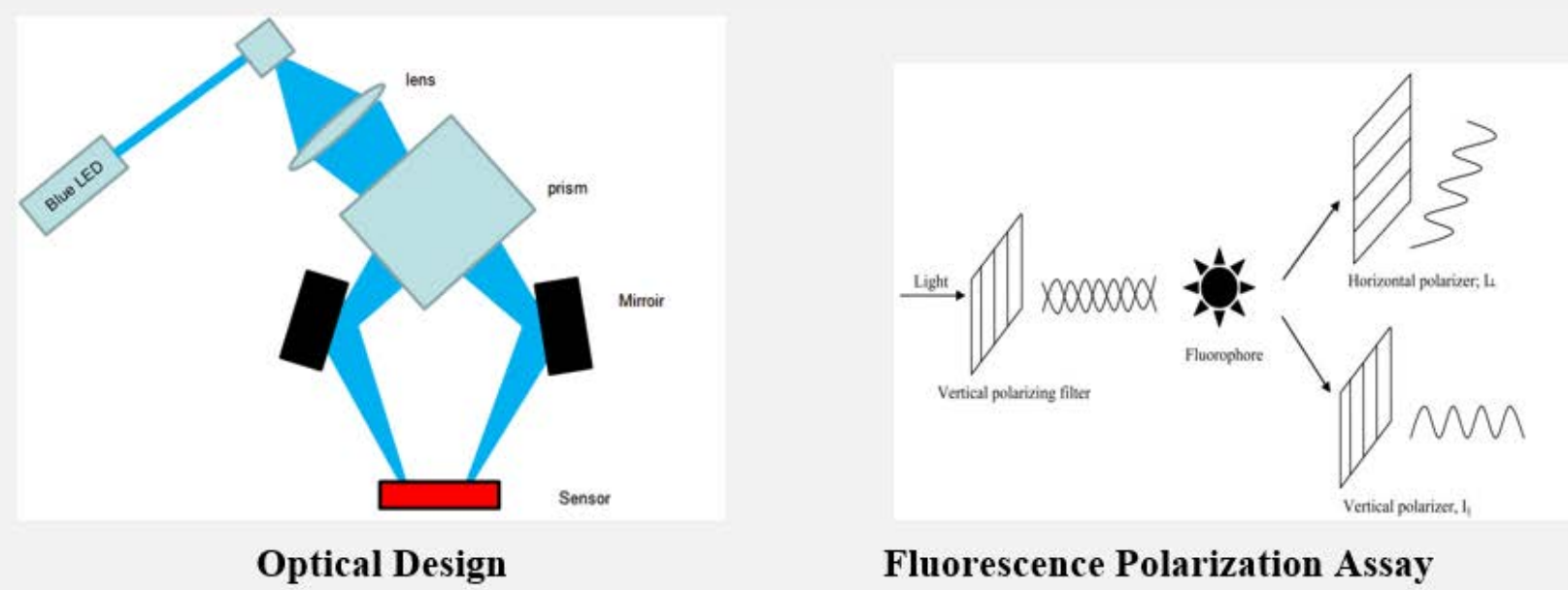
Introduction

In our project, we have developed a mobile sensor technology for performing detection and identification of viral and bacterial pathogens. This smart-phone based device system will bring new innovation on Fluorescence Polarization, and also offer people convenience on health diagnosis.

Innovations

Portable Based Device System has been the trend in the world for a period of time.

Project Design

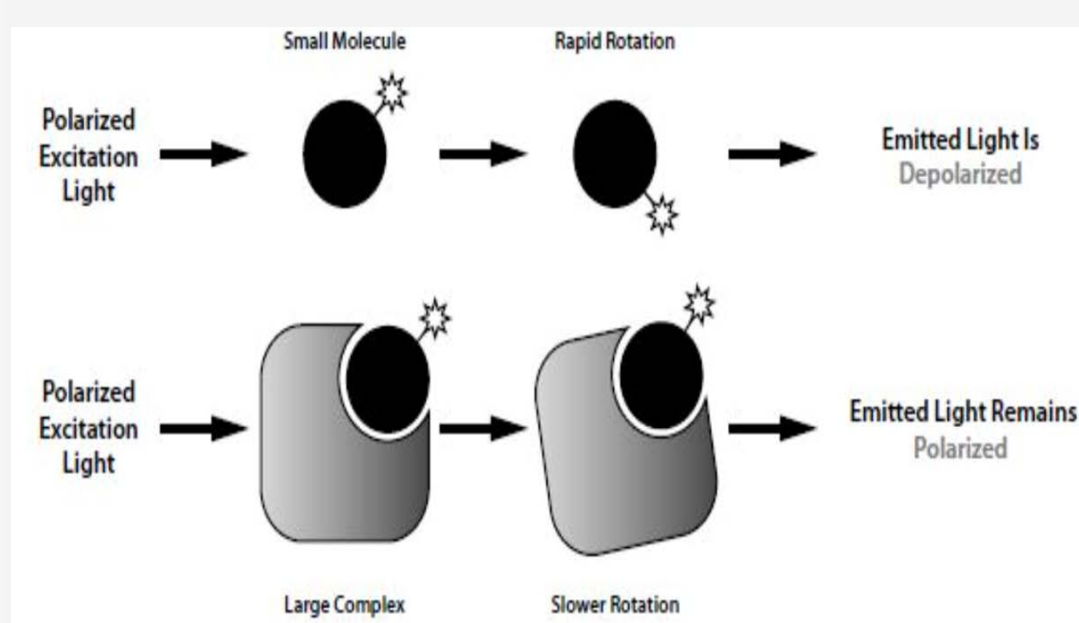


- Using Code V to design optical model
- Designing structure by Solidwork
- Developing App for fluorescence polarization

Fluorescence Polarization

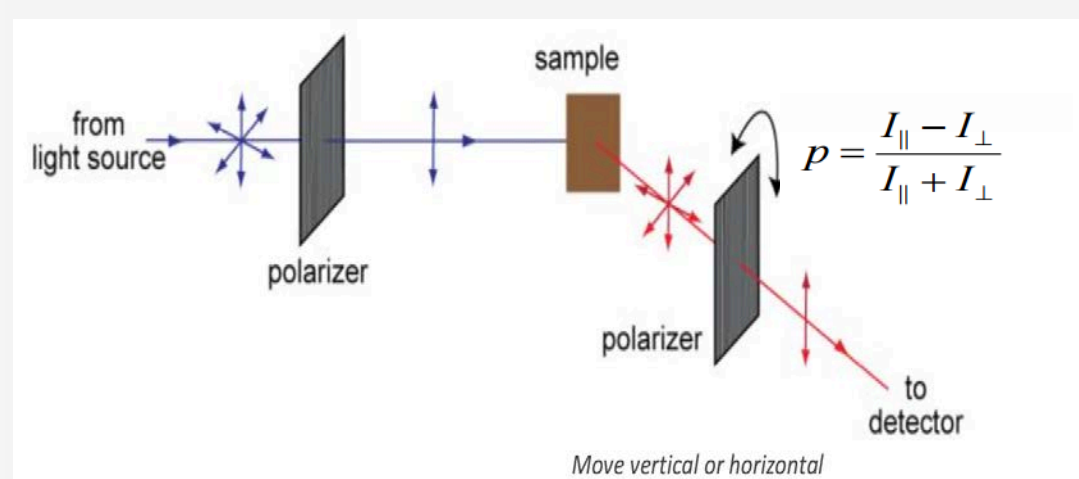
- FP measurements are taken in real-time, experiments are not limited to equilibrium binding studies.
- FP is truly homogeneous technique, so it does not require the separation of bound and free species.

Principle



Small molecules rotate quickly during the **excited** state, and upon emission, have low polarization values. Large molecules, in this case caused by the binding of a second molecule, rotate little during the excited state, and therefore have high polarization values.

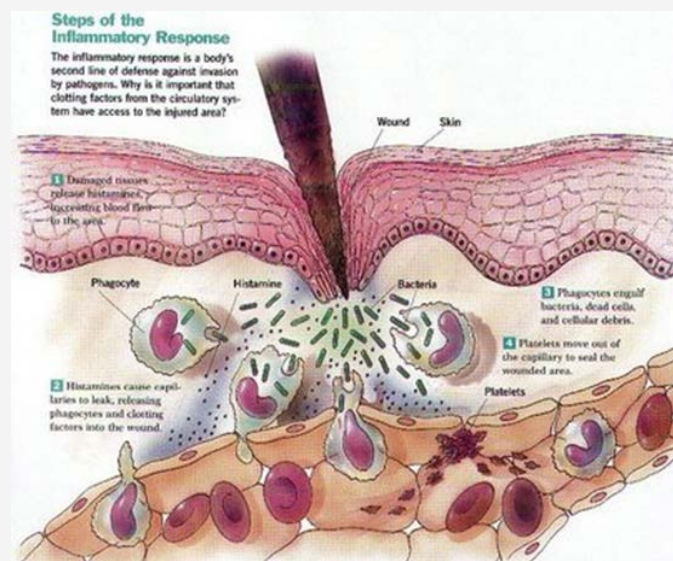
Measurement



where $I_{||}$ and I_{\perp} are the intensity measurements of the emission signal made parallel to or orthogonal

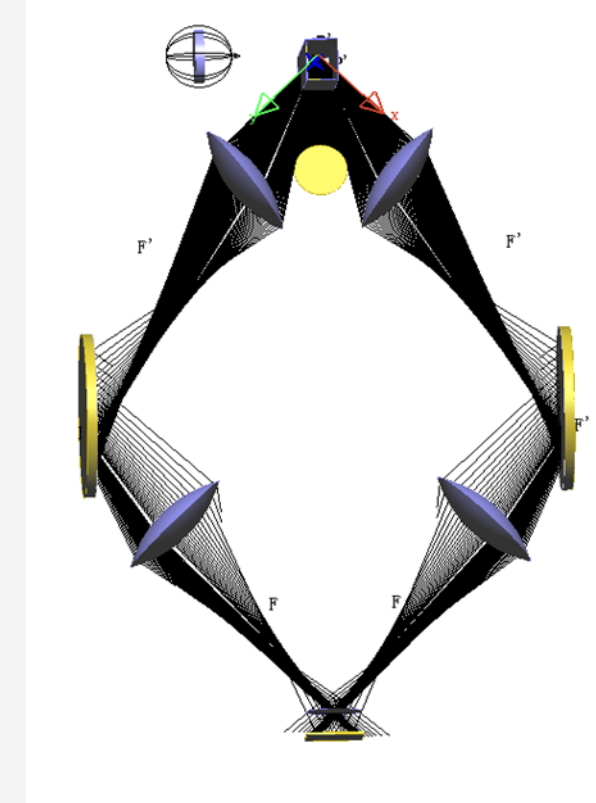
R6G and C-Reactive Protein

We choose R6G (Highly fluorescent dye) and glycerol (Big molecules) to test our design in first semester to make sure it works well. Then we choose C-Reactive Protein (The infection or tissue injury on body, which rises proteins) to replace glycerol to measure data in real life.

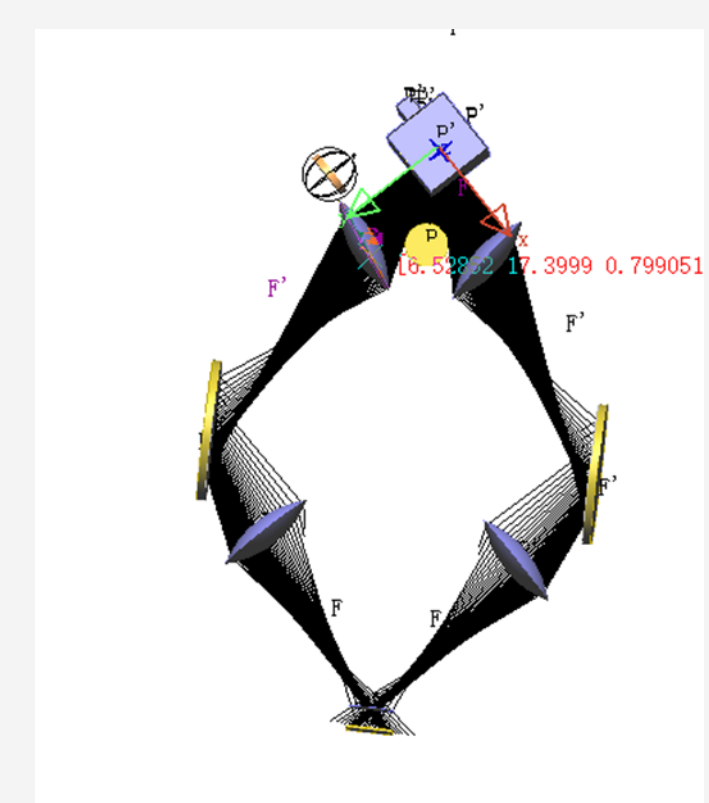


Optical Simulation

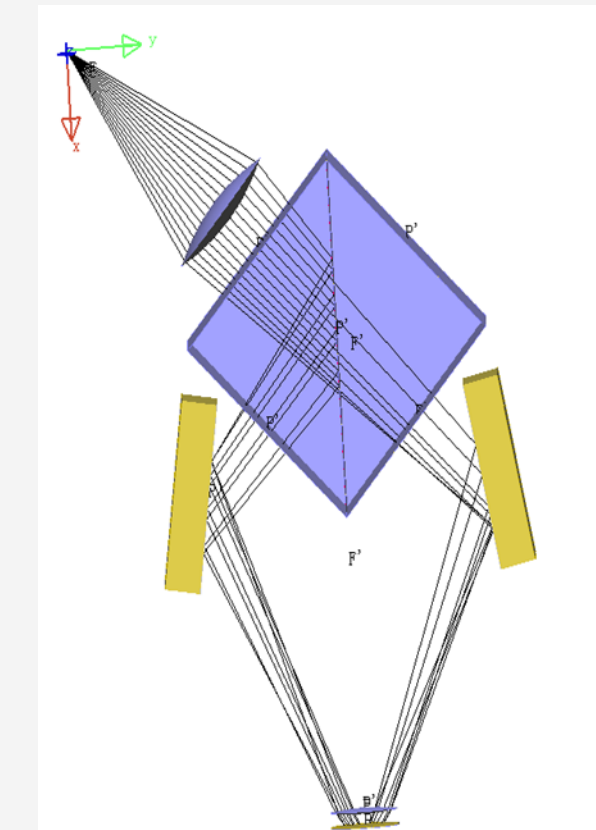
1st Generation



2nd Generation



3rd Generation



Comparison:

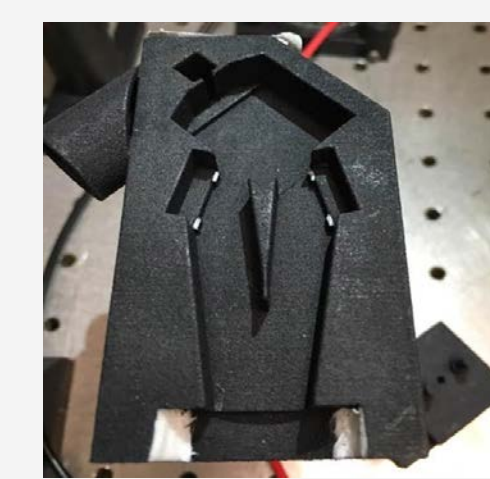
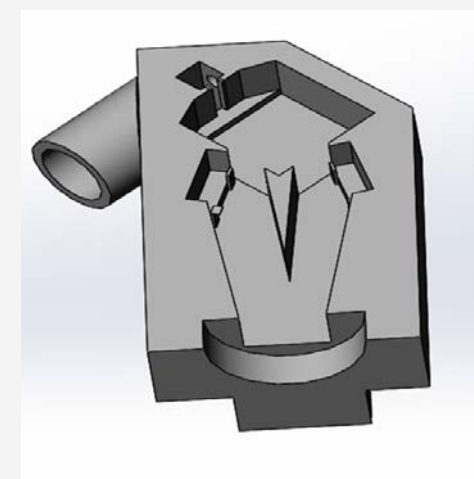
Compare to our first generation we add a prism there to separate the lights but the whole system is still too complex. Thus, in our third generation, we delete all the lens after the prism. We just use a small convex lens to gathering the lights before the prism the whole system will look very simple and clear.

Parameters:

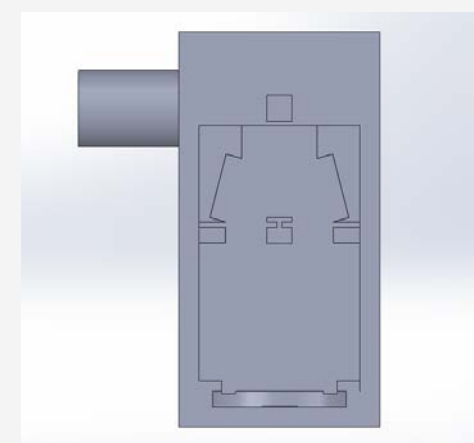
lens: diameter is 12.5mm. focal length is 16mm.
sample: 5mm width and 20mm height.
Whole device: 60mm width and 80mm length.

Set Up Design

First Generation



Final Generation

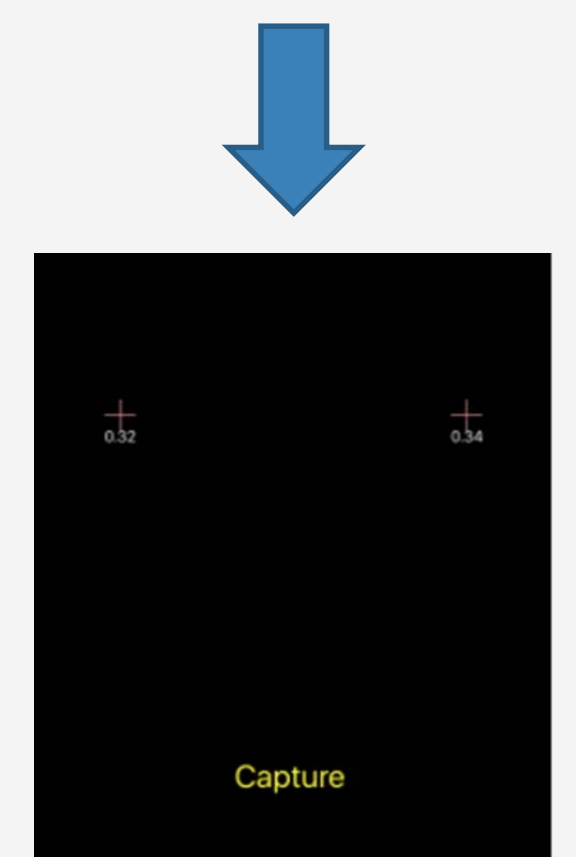
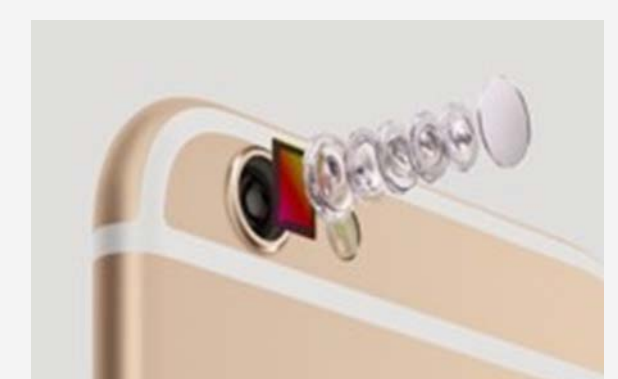


Advantages of final Generation:

- Size is larger.
- Structure is more compact.
- We use the beam splitter to get the image clearly.
- Increasing the ratio of the light beam.

Fluorescence Polarization APP

- APP is android based operating system.
- Phone's Camera collects the reflected lights from two samples.
- On camera UI, two indicators with attached data are changed dynamically. The data is refer to the calculated FP result based on the pixels and light intensity.
- Once data is captured, the screen shot image with data on it will be saved in local storage.



Conclusions

We work very hard in this year and our project will be appear on the market, it should be make contribution to the field of medicine and life science because through the APP it can easily to get the data to analyze, small molecules substances such as drugs content in the sample.